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AN  
INAUGURAL ESSAY  
ON  
PHYSEODESMOS:  
OR  
THE TIE OF CREATION,  
FOR THE DEGREE OF DOCTOR OF PHYSICK:  
*Submitted to the consideration*  
OF  
THE HONOURABLE ROBERT SMITH, PROVOST,  
AND OF THE REGENTS  
OF THE UNIVERSITY OF MARYLAND.

BY  
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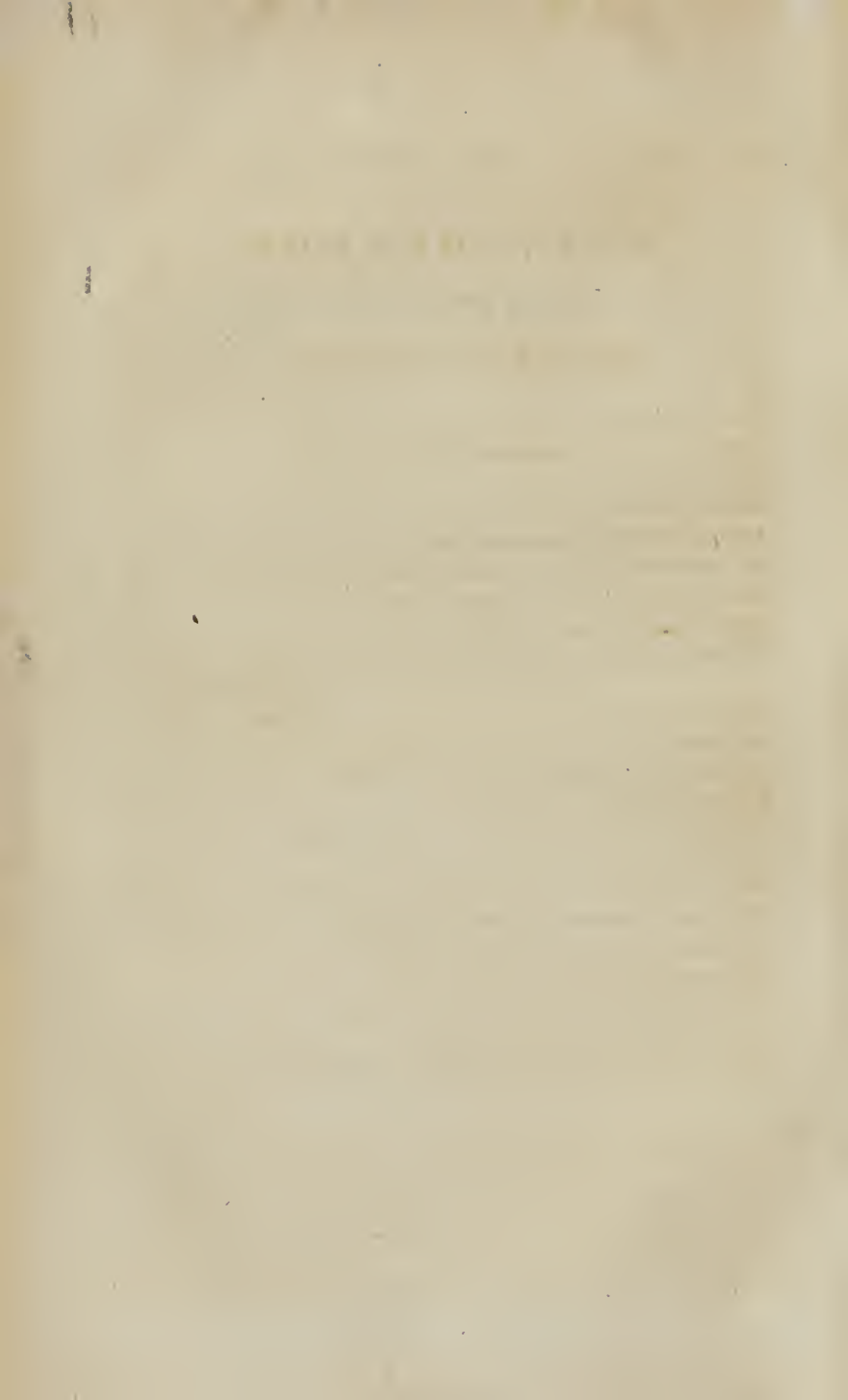
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# PHYSEODESMOS:

OR

## THE TIE OF CREATION.

Principio cælum ac terras, camposque liquentes,  
Lucentemque globum Lunæ, Titaniaque astra,  
Spiritus intus alit, totamque infusa per artus  
Mens agitat molem, et magno se corpore miscet.  
Inde hominum, pecudumque genus, vitæque volantum,  
Et quæ marmoreo fert monstra sub æquore pontus.  
Igneus est ollis vigor, et celestis origo  
Seminibus, quantum non noxia corpora tardant,  
Terrenique hebetent artus moribundaque membra.

VIRG. *Æn.* lib. 6.

Know first that heaven and earth's compacted frame  
And flowing waters and the starry flame,  
And both the radiant lights one common soul  
Inspires, and feeds and animates the whole.  
This active mind infused through all the space,  
Unites and mingles with the mighty mass.  
Hence men and beasts the breath of life obtain,  
And birds of air and monsters of the main.  
Th' ethereal vigour is in all the same,  
And every soul is filled with equal flame;  
As much as earthly limbs and gross allay  
Of mental members subject to decay,  
Blunt not the beams of heaven nor edge of day.

DRYDEN.

THE material universe presents a magnificent system of systems to the admiring and astonished eye of contemplative man.—Coeval with his existence was his admiration of the stupendous works of nature, and with the dawn of science did he attempt the investigation of

her laws. The ancients unweariedly laboured in this mine of knowledge; and how near their reiterated efforts, unaided by borrowed learning and school-taught philosophy, approached the truth, the world have ingenuously enough decided. Their opinions were transmitted to posterity with the imposing sanction of antiquity. Yet not long did modern genius wear with contentment the chains rivetted on her by ancient learning; she burst her fetters and boldly advanced to the field of speculation.

The splendour of the heavenly bodies and the uninterrupted harmony of their motions, early attracted the attention of man, and engaged his most serious consideration. The human mind, ever active, ever industrious in searching out causes, could not with silent delight behold this grand display of nature; it was roused to extraordinary exertions, and prompted to inquire what cause or power could give such beauty in arrangement, such grandeur in order, and such sublimity in effect. In this great effort to arrive at philosophical truth, the mind reposed its faith on nothing short of divine presence and omnipotent operation. It was believed that he who created was omnipresent and sole director.

These limited though commendable views of the operations of nature have been gradually extending, as the sun of science rose above the horizon of ignorance and dissipated the mists of superstition. The mind instructed by sacred history and enlightened by the lamp of philosophy, has now more noble and just conceptions of the attributes of an infinitely wise and powerful creator. From the former we learn that God created the heavens and the earth, or, in other words, that he created all matter; and by the latter we are taught, that when he com-



menced the grand work of ereation he chose to operate by second causes, “and that suspending the constant exertion of his power he endued matter with a quality, by the exertion of which the universal economy of nature might be uninterruptedly continued without his immediate assistanee. This quality has been ealled attraaction, an approximating influence with which all bodies are found to be possessed.” The voice of skepticks and immaterialists being hushed by the dictates of common sense and the palpable demonstrations of nature, we unhesitatingly express our belief in the existenee of matter, and of its having been summoned into being by the will of an omnipotent God. Synehronous with the formation of matter was its endowment with certain properties, and connate with its existenee was its obedience to certain laws: these properties and these laws emanated from the souree of all being.

The laws of attraaction were the first in their operation on matter, for a disposition in material partieles to assume a certain relation to each other is inseparable from the existence of matter; this disposition we call attraaction.

For the reasons to which we have before alluded, man early engaged in the study of astronomy, but the numerous opinions that were for many centuries offered to the world on this highly important subject, seemed more to resemble “philosophical dreams than the conceptions of waking and sober reason.” The correet investigation of that power which holds the universe in order, and directs the revolution of systems, was left to the illustrious Newton. To him we owe our knowledge of that agency, gravitation or attraaction, upon which ereation hangs; by him we are taught the obedience of a beam of

light to the self-same power that draws to the earth a projected ball; “and to the same great genius does chemistry owe the first distinct philosophical elucidations of the powers which produce the changes and apparent transmutations of the substances belonging to the earth.”

Before proceeding farther it will be necessary to remark, that we are disposed to reject all repulsive powers, as finding existence only in the imagination of man. This we do with less hesitation, from feeling a persuasion that all the phenomena supposed to be explainable, by an appeal to a repulsive power, are only to be properly solved by rejecting it in toto, and resorting to attraction.

In our remarks against the existence of any repulsive agency, we shall commence with the consideration of an opinion of high origin, and one that has been warmly supported.

In order to account for the earth revolving in her sphere we are told to imagine the existence of two forces, a centripetal and centrifugal; and we are confidently told that by the antagonizing action of these powers, she is necessarily carried around the sun. To admit a centrifugal force to exist, would be giving to our fancy a more extended range than we are disposed: more satisfactory reasons present themselves for its rejection. The first is, that the revolution of the planets could not be produced, even by the aid of such an agency. These two opposing forces are supposed to be possessed by a body, namely the sun, which occupies the centre of the solar system; and as they act from the same point, the sun, and act on the same body, the earth, it consequently follows that their energies must be exerted in the same line; now from a well-known law, observed by antagonizing forces in their action on a body, the body so acted

on can only be removed in a line correspondent to the line of action, and when an equilibrium is produced between these forces, the body acted on necessarily becomes motionless. Thus viewing the hypothesis we see its insufficiency to account for what it was professedly proposed. Again we are disposed to reject it, from its leading to the singular opinion, that the sun, the supposed centre of motion was possessed of two opposite and warring forces, a possession which no form of matter subjected to man's observation has been found to have; and as facts are wanting in its support, we might at least have expected analogy.

If the existence of a repulsive power be still advocated, and we cannot admit it to be possessed by the sun, we are led to an idea still more singular and unphilosophical, namely that it is an independent agent or quality, as if it were possible to conceive of a quality without thinking of an object by which it is possessed.

We should derogate from the Omnipotence of the Creator, by an unnecessary multiplication of instruments in his hands, and greatly detract from his infinite wisdom, so perspicuously displayed in his grand work of Creation, by resorting to diversity of cause to produce diversified effects; and still more so by compelling him to resort to two causes to produce one effect.

Electricity has been supposed to afford conclusive arguments in support of a repulsive exertion. Two light bodies, as two cork balls, suspended by silk threads similarly electrified are said to repel each other, and are only attracted when in different states of electricity. That these phenomena do take place, is a fact, but whether they arise from an attraction in the one case and a repulsive exertion in the other, we shall presently see. The

electrical fluid has an attraction for itself and for all other matter ; which is proved from its being found more or less in all bodies, and when accumulated in one, will constantly endeavour to arrive at an equilibrium. Now in the case of the two balls, which we first suppose to be in plus, the accumulated fluid in each has a strong attraction for itself and other bodies, which increases the quantity ; there being no body to which it can readily impart itself, and being possessed by a light moveable one, the electricity carries the body along with it in pursuit of itself in a different state. If to one of these balls we present a body in minus, it imparts its excess of fluid to the body and is then attracted by the other ball, but as soon as it receives another portion it will recede in pursuit of another body to which it can impart a portion of the accumulated fluid.

In this way we account for the apparent repulsion, ascribing it to the attraction the electrical fluid has for itself in a different state. In the case of two balls in minus the same result takes place ; from their having less of this fluid than the surrounding bodies, and from their being light and moveable, they will be moved towards such bodies as possess the electrical fluid in plus : in short the explanation is precisely the same as the above.

An appeal has likewise been made to magnetism for arguments in support of a repulsive exertion. If to the north pole of a moveable magnet A, we present the same pole of another magnet B, A will recede from B ; not from being repelled, but from the north pole of B attracting the south pole of A and thereby giving the appearance of repulsion between their north poles. This effect proportionably increases with the power of the magnets ; so we see this agency obeying the same laws as many

others, namely its energy increasing as the quantity, or its attraction for itself is as the difference between its two poles.

Caloric or the matter of heat, styled by Sir Humphry Davy the power of repulsion, has been supposed to produce many of its phenomena by its exerting a repulsive power.

This subtile fluid pervades all creation, and acts a most distinguished part in the economy of nature. One of its most obvious effects is the expansion of bodies; which is said to be effected by the calorific particles strongly attracting all others but energetically repelling each other. We shall take water as affording the most familiar examples. In the solid form or that of ice its situation is preserved only by the peculiar attraction, happily called polarity, existing between its particles and binding them together. For the ice to assume the fluid state this attraction must be overcome, which can be effected only by the aid of some superior affinities. Caloric, the liquefier of almost every form of matter, insinuates itself into the ice, carrying along with it all its attractions both for itself and other substances, chemically combines with the particles of ice, which now lose their attraction for each other, and begin to take on the fluid form, which must result from the particles of caloric so forcibly attracting themselves and those of ice as to suspend the polarity existing between the particles of ice. In short the state of fluidity is owing to the chemical combination between the particles of ice and the matter of heat; and is as purely chemical, as the union of oxygen with any base forming an oxyd or an acid. We suppose every addition of caloric to a body to be chemical, and expect correspondent changes in the properties of the body.



That the matter of heat can combine with a body only from the affinity between them must be admitted, and if so, we must expect changes in the body, as the result of this combination.

The case of a given quantity of air being expanded by heat affords proofs of the energy of the affinity of the matter of heat for other substances. The attraction between the particles of air is feeble and easily overcome; and if much caloric be added the air is subjected almost to the tenuity and laws of heat itself. The caloric here has but little opposition to the exertion of its affinity for other matter; it exerts it, but the particle of air has an attraction for the particle of caloric that has seized on it, and this attraction is so strong as to permit the particle of air to be carried along with that of the caloric, in its pursuit of another body, or in its obedience to its unerring law, namely, attraction for all matter. Thus we account for the expansion of bodies by caloric; attributing it to the attraction for itself and for other bodies, and not to the repulsion of its own particles.

We want not analogies in support of the opinion that the particles of air are carried along with those of caloric, from the attraction existing between them. The most philosophical and scientific opinion ever offered in explanation of that process called evaporation is founded on a similar supposition.\* Agreeably to this opinion water has a strong attraction for, and is combined with air which is very expansible; and when the water is exposed to heat the air expands and rises from its levity, but in consequence of the attraction existing between the air

\* The opinion alluded to was advanced by the Professor of Chemistry in the University of Maryland.

and water, a vesicle of water is carried along with the expanded air; so we see that one set of particles may lose their polarity for each other, but be so united to another set, as to be carried along with them in their regular changes.

Another similar effect is produced in galvanic exertion. In the experiment in which sulphuric acid and an alkaline solution are made parts of the circle, the sulphuric acid is so seized on as to be carried insensibly through the solution, for the alkali of which it has a powerful attraction, without manifesting the least action on it. We recollect that this experiment has been supposed to prove that the galvanic fluid exerts a repulsion between the acid alkali, thereby preventing their union: but we imagine the whole to be explainable from the energetic attraction existing between the galvanic fluid and the acid, preventing the acid from uniting with the alkali. In a word, the affinity between the acid and galvanic fluid is superior to that between the acid and the alkali.

The experience and observation of every chemist prove, that in evaporating many of the saline and other solutions to dryness, much of the article is lost, although it be far less volatile than the menstruum, by its evaporating with it, from the reciprocal attraction existing between them.

Sir I. Newton has shown that when a convex lens is put upon a flat glass, it remains at the distance of  $\frac{1}{137}$  part of an inch, nor does any mechanical force which can be applied, bring them into *actual mathematical contact*. Hence it is concluded that a repulsion exists between bodies. We are disposed to think that what is meant by *actual mathematical contact* differs in nothing from what we mean by *chemical contact*, which cannot be effected by

any mechanical powers, as it is produced exclusively by corpuscular or chemical attraction. So that if the glass lens and plate do not come into contact, it is owing to the lens and the plate having a strong chemical attraction for the interposed medium, and not to repulsion.

Having considered cursorily the important facts and opinions adduced in support of a repulsive agency, and having arrived at the discovery and establishment of gravitation, or attraction, the tie of creation, by whose exertion worlds sprang into order, assumed their forms, regulated their distances, revolve in their spheres, and continue to preserve their stations, we shall take it as our *Palinurus* and now embark on the sea of investigation.

Chemical philosophy has taught us to consider every form of matter as possessed of attractions or appetences peculiar to itself. With the nature of this quality we have no knowledge, but content ourselves with observing its laws, which are found to be few and steady in their operation. We only know its existence by its phenomena, and this is the active or as we would call it the living principle in all matter. In observing its exertion in different bodies we discover a striking similarity, and are disposed to believe it is possessed of many common properties; however there is an evident peculiarity in it, as possessed by individual substances, which we conceive to be the cause of all the difference in the qualities of matter, and to be in strict conformity to the original design of the all-wise Creator. Viewing all disputations about the ultimate forms of material particles, whether they be triangular or not, as idle, and tending rather to perplex than advance science, we shall content ourselves with the above assumption, and taking the advice of the school-



men proceed to lay down our principles in the form of a proposition.

The quality with which matter is endued, whether called attraction, spirit, or life, possesses the power of commencing, and communicating motion to matter; by its exertion, motion was begun and now is continued. Farther, the same quality or attraction which now directs the universe called order from disorder, gave form and variety to the earth, and moulded beautiful and complicate man.

It may be expected that we should say something in justification, or, at least, in explanation of what we mean by the life of matter. By it we wish to express what the chemico-philosophers understand by affinity, or chemical attraction, or that principle in matter, to which it owes its sensible and other properties, and by which it is enabled to act. Oxygen by its affinity, or life, is disposed to unite with nitrogen, which it does with the suspension of the life or properties both of itself and nitrogen. But a compound is formed possessed also of its life, which alone gives it all the distinguishing properties of an acid. We speak as correctly when we talk of the life of an acid, as we do when we speak of vegetable life. This life or appetency we suppose to be as indestructible as matter; and as it was at the creation stamped indelibly by the hand of the Creator on all material particles, we expect to observe it manifesting itself by its exertion, whenever the particles are brought to their primeval state by being disunited from their multiplied combinations: nor are we disappointed in the expectation; for, let the chemist torture an article as he may, by various combinations, &c. and again reduce it to its individual character, it will immediately present all its characteristic properties. From this it will be inferred that we are disposed to use syno-

nymously the terms attraction, affinity, appetences, and life as just defined.

We have said that by attraction motion was begun and is now continued. By this we mean that the quality or essence with which the matter is endued, is in perpetual operation or exertion, the result of which must be a continued change in the forms and sensible properties of substances, and to effect this there must be motion. All bodies act by this quality, and no one can be so situated as to be exempted from the action of the surrounding bodies; and no sooner has a body been acted on, and some change thereby made on it, than it is immediately exposed to other influences, or so acts itself, as either to change the properties of the body acted on, or be changed itself. In this way we account for all changes in material particles, for the commencement and continuance of all motion, and come to this conclusion, that the "laws of motion are the laws of nature."

The heavenly bodies owe their motion to the same war of attractions; without it, motion might have been commenced, but must have had a termination. Assuming it as an axiom that all matter possesses this quality of attraction, and by it is made to move variously, and take on diversity of form; and that it is physically impossible for any body to be so situated as to be exempt from the action of others, we come to the natural conclusion that matter must be ever moving.

We shall commence our illustration by an appeal to the planetary system. The earth, we say, is disposed by gravitation or attraction to approach the sun; she is obedient and moves towards him; but her situation is such as to expose her to the attractions of Mercury, Venus, Mars or all the heavenly bodies, and by their action she is

prevented from approaching the sun. As these other orbs act in various directions, the earth cannot be stationary ; she moves, and by moving gets more or less out of the attractions to which she was first exposed, but is immediately subjected to others ; so her motion is continued and she is carried round the sun in her ellipsis. The same mode of speaking we are disposed to apply to all the planets and heavenly bodies ; and ascribe the harmony of their motions to the exact equipoise between their several contending attractions. Thus viewing the subject, we can conceive of the beautiful simplicity of nature, of which we have heard so much, and read in golden characters irrefragable proofs of the infinite wisdom, illimitable power, and benignity of the Supreme Being. From this source the glorious cause of religion gets its strongest holds, and philosophy its most impenetrable shield against the darts of impiety. We presume to maintain, in the language of professor J. Gregory, that those philosophers have been the firmest supporters of religion who have employed their genius and application in the investigation of the works of nature, and whose views in science have been grand and extensive. With him we need only mention the names of Boyle, Bacon, and Newton.

From this digression we return to see how far a war of attraction was competent to have called order from disorder, which is the first part of our proposition.

We have before quoted, from high authority, that in the beginning, God created the heaven and the earth, and the earth was *without form and void*. Over this chaotic mass darkness hung, and from this embryo of worlds, by Divine command, attraction moulded the material universe, gave form and variety to all earth's parts, and yet directs the whole. To come to this conclusion requires

no stretch of fancy or flight of imagination ; we have but to advert to our first fair assumption, and suppose the germes of future worlds to be mingled in this formless mass, and their parts all possessed of their individual lives or appetences, ready, at the summons of the creator, to rush to action obedient to their own laws. What jar-rings, what contentions, and what warrings there were in this struggle of universes, we shall not attempt to describe ; but conclude that this toss of worlds and wave of systems continued until each orb, both balanced and was balanced in the scale of order, and moved harmoniously, obedient to each other's powers.

“ Then founded, then conglob'd  
Like things to like, the rest to several place  
Disparted, and between spun out the air,  
And earth, self-balance'd, on her centre hung.”

When we have it demonstrated to us, that it is attraction that gives accuracy of form to the smallest crystal, that forms and preserves the various strata of our globe, that gives diversity and variety to all earth's parts, and in short gives form to the earth herself ; we should not be astonished to hear that by the summons of this same power, earth sprung from primeval chaos. Again, taught by the suggestions of common sense and the soundest philosophy, that all form is dependant on attraction for its preservation, and believing that the universe is but a widely extended form, we are irresistibly drawn to the conclusion that it is as dependant on attraction for the preservation of its totality as the most delicate crystal. Farther, as all the changes in the forms of matter, either from composition or decomposition, since the commencement of human observation, and as all the present trans-



mutations in the forms of the parts of our globe are dependant on attraction, it is just to conclude that the earth owes her form to the same power; for that which forms and adjusts the parts may be said to form and adjust the whole. Now as the earth is only a part, "an atom," and is dependant on attraction for her form, and is bound to the rest of creation by the same power, it is fair to infer, that the universe is as dependant on attraction for its adjustment, as its parts. Since then the universe is dependant on attraction for all the variety and diversity of its form, and for the uninterrupted harmony of its complicated motions, what other than the same power could have given form to a formless mass, and brought order from disorder.

We well know that this has been supposed to be the immediate work of the Creator; but we flatter ourselves we shall not detract from his high supremacy, by supposing this admirable work of adjustment and adaptation to be effected by a quality, with which he, in his infinite wisdom and goodness, was pleased to endue matter; but rather will it excite a sense of admiration and a spirit of the highest adoration of that Being who has so beneficently formed and graciously bestowed on matter a principle, which unaided, conducts the complex machinery of nature.

"By this tie of worlds orbs roll without a clog  
And ennobled man and all earth's proud tribes  
In their destined spheres, all unwearied move."

We have now established the first part of our proposition, namely, that attraction called order from chaos; and to prove that it gave form and variety to the earth will scarcely require an argument. This second part of

our proposition happily has for its support and establishment the light of chemical science, whose operation is as boundless and as unlimited as the universe.

Agreeably to the Mosaic history, the ancients believed in the origination of our globe from chaos. The divines have assiduously endeavoured the justification of the Mosaic account by an appeal to the laws of nature, and had these laws been better understood, their endeavors might have been crowned with more complete success. The astronomers have taken a considerable part in these considerations ; but really their minds seemed to be so completely under the influence of comets, that they are frequently carried beyond the spheres of science and philosophy. The chemico-philosophers have been the most happy in their geological researches, and their success has been proportionate to the correctness of the application of chemical laws.

All writers on geology, with a few exceptions, agree in considering a chaotic liquidity as the primeval state, and had they thought less of external crusts and the eruption of volcanic fires, and more patiently examined the materials of our globe, together with their structure and reciprocal action, they might have been led analogically to the explanation of the great desideratum.

The most approved and respectable geologists differ only as to the solvent ; one set saying the material are in fusion or solution in caloric, and the other that they are dissolved in water. Hutton was at the van of the former and Werner of the latter. Each had its advocates, the question is not yet settled, nor does it affect our purpose that it should be : however we incline with the majority to the Neptunian theory or that of Werner, as most philosophical and applicable to the appearances of

our globe. In support of a solution we shall merely remark, that many parts or rather substances of our globe have most decidedly the crystalline form, and that all crystallization argues strongly previous solution or fusion.

This menstruum we suppose to have held in solution all the elementary substances, possessing their lives, attractions, or, if you please, idiosyncrasies; and that each article was disposed, from its peculiar appetences to take on its own form, or in other words, to crystallize after its own manner, which it would have done inevitably but for the interfering of other crystallizations or attractions. In consequence of this struggle of attractions we find them variously combined and possessed of all possible forms. Such as have slowly and undisturbedly gone through this process present us with the most perfect form, but the same article from a disturbed and hurried crystallization will give us irregularity of form.

We have in recollection that the subject of crystallization has much engaged the attention of chemists, and given birth to numerous opinions, but the one ascribing it to the exertion of an attraction resembling polarity, we shall adopt, as it is in conformity to our general principle; and with much pleasure do we introduce the following passage from Sir H. Davy, in corroboration of our opinion. "The laws of crystallization, of definite proportions, and of the electrical polarities of bodies, seem to be intimately related; and the complete illustration of their connection, probably will constitute the mature age of chemistry."

Whether we view the external surface of the earth, explore its caverns, or penetrate its solid parts, and examine from the grain of sand to the rock or to the mountain, we discover no substance that does not give some

peculiarity of form and afford most satisfactory proofs of the exertion of a polarity or attraction between its particles. Since, as before remarked, all form is dependant on attraction, and as the earth has a form as defined as an individual crystal, we conclude she is also formed by the same power, and trust we shall hazard no confusion in terms when we call the earth a crystal of crystals. Thus we see how far we were correct in saying, in the second part of our proposition, that attraction gave form and variety to the earth, and now come to the third and last part, namely, that it also moulded beautiful and complicate man.

Regulating our inquiries by the scale of nature, and ascending from the consideration of the elementary to the compound substances, we should next to the mineral kingdom direct our attention to the vegetable, and see how far our principle is applicable to the explanation of vegetable phenomena. However, we intentionally omit in this place any particular remarks on vegetation, and proceed to the consideration of man, hoping our observations on physiology will be such as to give distinctly our views on vegetation.

When we observe the dependance of animated nature on the rest of creation, and behold the three kingdoms as they are called, viz. the mineral, vegetable and animal, gliding into, and reciprocally contributing to each other, we are naturally led to suspect the possession of some common principle ; and when we resort to analytical experiment, that abundant source of knowledge, we are enabled to detect in all the same elementary substances possessed of their individual lives ; and as the animal and vegetable powers work on the same materials as the mineral, and as the life of these materials is the only ce-



menting and formative principle of nature, we conclude that the parts of animals and vegetables owe their form, their adaptation, their assimilation, or, as we call it, crystallization, to the same quality. We have seen that the ultimate particles of all forms of matter, are possessed of a life, or crystallizing or growing principle as indestructible as matter ; that by this principle matter is alone moved, rendered active, and variously combined, giving us compounds also possessed of lives that differ in their expression, but that necessarily belong to each combination. To say that the elementary substances enter into the composition of man without exerting their individual lives or crystallizing powers, would be at once to insulate him from all nature, and give to the animal powers an ability to annihilate the life of matter. Rather would we say man is indissolubly connected with the rest of creation, “ a distinguished link in being’s endless chain,” and that the Creator has employed the same instruments in his admirable formation that he has in moulding the universe.

Aided by the lights of anatomy and physiology, we behold a constant appropriation of elementary or compound substances to the purposes of the animal economy ; we see our food, whether animal or vegetable, subjected to the process called digestion, thereby converted into a mass called chyme, this by another process so altered as to get the name chyle, which then takes its destined course and by some unknown process is changed to blood, and from this in its turn, by some alike inscrutable power, the bone, muscle, tendon, &c. are formed : nor does the process rest here, but every part, when it has performed a certain office, by some means, dissolves into a fluid, which is carried by its appropriate vessels into the circulation, to be

eliminated from the general system. "So we see the animal body is never for a moment stationary; the remotest part is in action, and every point is suffering a perpetual change."

As we cannot consent that the animal powers are capable of bereaving elementary substances of their lives or crystallizing principles, we conclude they must be active in the process of assimilation or animalization, and if so the substance or part may be said to crystallize. The whole process of secretion, whether a fluid or solid be the result, must be effected in this way. It is maintained they are all formed of the blood by glands or the capillary ramifications of the arteries; but we conceive that the arteries and glands perform no other office in the secretory process, than so to dispose the elements of the blood as to permit the play of particular affinities, so as to unite them in the formation of bone, muscle, tendon, nerve, &c. We do not speak correctly when we say a chemist in his laboratory forms an acid; he only can by certain manual operations so arrange the articles, as to permit their reciprocal affinities to be exerted, and thereby form the acid; so we see that it is chemical affinity that forms an acid and not the chemist. This case is precisely analogous to animal secretions; the arteries and glands are but chemists operating in their respective laboratories on the common reservoir of blood. Happy we are to find the same opinion expressed by John Bell, "that mound over which the tide of ignorance never flows." This correct physiologist says "our admiration is strongly excited when we observe the system to consist of fluids and solids, and the existence of the animal to depend upon the balance of their power; the fluids separating and combining in new affinities, and forming the

various secretions ; and the solids having action, and that action controlling the affinities and new combinations of the circulating fluids."

Agreeably to this and our own opinion the secretions are but the fluids separated and combined in new affinities. All the solids are as pure secretions as the milk, saliva, tears, &c. and must be formed in the same way, namely, by their affinities. But the solids have action which controls the new combinations; whence is their capability of action derived but from their peculiar combinations, and if so we are yet secure in saying every part is a crystal, and that man is a moving crystal of crystals.

Laying aside analogical arguments, we are disposed to adopt the above opinion from its affording a perfect solution of many of the unsettled and embarrassing physiological points. Why has man his peculiar form, whence the form of his finger or arm? are questions, to settle which physiologists have laboured in vain. Many hypotheses have been offered, some for a time have been popular, but they have generally been ephemeral. This is one of the many subjects on which we are told to be silent, and remain contented in the belief that the form is such as the Creator has directed or willed. To this we readily assent, and are disposed to think the work of animalization to be the immediate effect of a principle operating according to the original design of the Creator. We incline the more to this opinion, because the adoption of an opposite would necessarily lead to the impious charge of partiality against the Creator. Granting that man grows in accordance to the original design of his God, should we not be justified in the expectation of all men being precisely of the same form and turn: but as there is deformity in one and perfect symmetry in another, we cannot,

at least we should not, ascribe this difference to the will of the Creator.

Aided by the analogy afforded us from the mineral kingdom, we come to a satisfactory solution of the above questions.

Every crystal has a form peculiar to itself, which it will invariably take, if it crystallize undisturbedly; but from the interruption of other similar processes it is made to assume great variety in form and appearance, and is so altered from its proper figure, that the best mineralogist, aided by the most accurate chemical knowledge, could not promptly say to what class it belonged; just so we conceive it to be with animals; if they grow in obedience to their own laws without disturbance we have the most perfect regularity and symmetry in form, but if interfered with they become distorted and deformed. Every crystal has its limits in form; so has every animal, and were it compatible with the nature of the physical world for animals to grow only obedient to their own laws, we should see between them the greatest similarity; and notwithstanding the impossibility of this exemption, still we behold a striking resemblance between the individuals of the same genus.

By the aid of this principle may we not account for children's likeness to their parents, the young of all animals to their parents, and even the fruit or germe to its tree. The foetus, the embryo in ovo, the germe in plants all receive at their formation this disposition to a particular adaptation or growth or crystalization, and when accompanying circumstances favour we see them grow up in the likeness of their original. Without supposing a disposition of this kind to exist we shall never be enabled to account for conception and foetal growth.

In the venereal orgasm there is a pleasurable meeting of the male and female products, each possessing affinities or crystallizing powers peculiar to itself, but also an affinity for each other. They meet and instantly there arises a crystallizing effort, or a war between their individual and common affinities, and as the male or female particles enter most abundantly into this new compound, so do they give more or less their own characters and appetences to it, and thus is laid the germe of future man or woman. If the crystal possess the female appetences, from having a larger portion of female particles, it grows obedient to them, and we have the female, and vice versa.

This view of that intricate subject leads us to the rejection of the idea that the embryo is a congeries of imperceptible tubes, and that the business of gestation is merely to unfold this net of the future animal. This is certainly an ingenious opinion, but will not account for the likeness of the child to the parent and many other circumstances. By the opinion we have advocated we satisfactorily account for those properties of the foetus common to the male and female, and also those peculiar to each sex. The male and female fluids supplied in this process must be composed of particles of matter, they must have form, and all form is dependant on attraction; these fluids are forms of matter or crystals and must have the likeness of their original, that is, they are parts of the great crystal man or woman, and as man and woman have many common characters, so must the fluids or crystals have. When these fluids come into contact their common characters enable them to unite, and those peculiar to each sex give rise to the contention and fix their likeness on the new crystal, and as before remarked, give the embryo man or woman. This opinion is in conformity to that high



authority which says all creation shall bring forth according to their own likeness, and man is as much obedient to this injunction as the crystals of the mineral kingdom.

By contemplating man in this light we shall have an intelligible physiology laid before us, and have the much agitated point settled, namely, whether animal life be a forced state or not; and farther we hope also to be led to a correct pathology and perhaps, be satisfied as to the plurality, or unity of disease.

As to animal life we can no more admit it to be a forced state, than we can the life of an acid, for that cannot be forced which is in strict conformity to the design of the Author of nature.

That which is the inevitable consequence of a particular conformation cannot be forced, but must be considered as the constant concomitant, and as necessarily belonging to it. The animal formation was in compliance with the will of the creator, and life or appetency was the consequence; so we cannot consider that to be forced which is in conformity with the plan of nature. The same principle and mode of reasoning are alike applicable to all the other physiological points.

The life in all forms of matter disposes elementary particles variously to unite; and from the time of creation there has been a perpetual war between the different substances of our globe. In this language we are warranted from the impossibility of an exemption of one form of matter from the action or affinities of another.

In the sacred volume, after having been instructed as to the formation of the world and all its inhabitants except man, we find this passage, let us make man after our form, from which we understand that man the emperor of the earth should have connected in him all the variety of ope-

rations that are widely diffused through nature, that he should be a universe concentred, a world epitomised, a microcosm ;

“ Connection exquisite of distant worlds!  
Midway from nothing to the Deity !”

Thus we see, from the complication of his structure, and his connection with the rest of creation, that he must have an incessant play of affinities within himself, and be perpetually exposed to the assaults of surrounding appetences ; or, in other words, he and all nature are at war. The surrounding appetences or affinities, from occasionally getting the ascendancy over those of man, become causes of either local or general disarray of the balance of his complex system. This disarray is disease.

When we are exposed to the action of an external cause, whether it be solid, fluid, or a gas, it can act only by the exertion of its life or appetences ; and if its exertion be so energetick as either to interfere with or suspend for a time the appetences of the animal system, we have disease. We are now led to the consideration of the unity of disease : and as all causes interfere with the operations of the animal economy, either by suspending or removing in toto their regular and healthful course, and so continuing their action as to produce their own likeness, which likeness is disease, we conclude that there are as many genera of diseases as causes.\* Every disease is an interruption in the animal economy, which is the consequence of the exertion of external or internal causes.

\* For this opinion we are indebted to the Professor of the Institutes of Physick in the University of Maryland.

These causes are matter in some form or other; and they act only by the lives or appetences inherent in them.

These lives act so as to unite their possessor, together with its peculiar laws and properties, to the animal system, thereby producing disease or their own action, which must be as diversified as the causes.

It is from this perpetual reciprocal action that nature has been said to roll in a circle, which she actually does, and without this incessant war and exertion, all matter would rest in a dreadful sleep, “as if the general pulse of life stood still, and nature made a pause.”







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